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## DESCRIPTION

Location Reporting Method and  
Related Mobile Communication Terminal

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## TECHNICAL FIELD

The present invention relates to a location reporting method and a mobile communication terminal for reporting the location of the mobile communication terminal.

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## BACKGROUND ART

The mobile communication network such as the cellular telephone is capable of detecting the current location of a mobile communication terminal. In recent years, various systems have been proposed for providing information service utilizing the location information acquired by the mobile communication network of the type described above. One of the services of this type using a PHS (Personal Handy-phone System) is the location information service for providing the current location search service for measuring and reporting the current location of the object of location measurement such as an aged person or an infant, the service for distributing the contents related to the current location, or the service related to the current location of a user or a person other than the user making up an object of measurement.

For carrying out the location information service, the current location of the person of which the location

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is to be measured is required to be measured. Generally, this location measurement is carried out by causing the person of which the location is to be measured to hold a mobile communication terminal such as a portable terminal, a PHS, a PDA or the like having the communication/ location measuring function, and causing a location measuring device to transmit signals to and from the mobile communication terminal for location measurement. The method of location measurement varies depending on the type of the mobile communication terminal held by the person of which the location is to be measured. For this reason, the conventional service providers for providing the location information service have provided the location information service only for the persons holding a mobile communication terminal of a specific type. Also, in providing the location information service to a great number of persons holding various mobile communication terminals, the service provider is required to prepare the location measuring means of various types to meet the requirements of the mobile communication terminals, thereby posing the problem of an increased cost of providing the location information service. Also, depending on the contents of the location information service, the requested location information may be required to be expressed in different forms. For example, a given service is desirably provided as the location information expressed by the latitude and longitude while another service is preferably provided by the location information expressed by an address (character

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string). In such a case, the location information service provider is required to prepare means for generating the location information in the form of expression suitable for each service provided. Under the circumstances, this  
5 imposes a large burden on the service provider for providing the location information service. Also, the user wanting to receive the service is required to take the trouble of specifying the method of location measurement and the method of accessing the contents in accordance with the method  
10 employed by the service provider.

#### DISCLOSURE OF THE INVENTION

The present invention which has been achieved with the aforementioned situation as a background, and an object of  
15 the present invention is to propose an interface protocol for supplying various computers with the location information of a mobile communication terminal to provide a common platform for supplying the location information with the aim of integrating networks.

20 Further, for supplying various computers with the location information of a mobile communication terminal in an open form, a new problem of the privacy of the user is encountered and requires a sufficient security measure to handle the problem.

25 In view of this, another object of the present invention is to supply the computers with the location information of a mobile communication terminal while at the same time maintaining the security for the particular

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information.

In order to solve the problem described above, according to the present invention, there is provided a location reporting method characterized by comprising the steps of: receiving by a mobile communication terminal, from a computer through a mobile communication network, down data containing a request for location information; acquiring by said mobile communication terminal location information indicating the location of itself; and transmitting, by said mobile communication terminal, after adding said acquired location information to said received data, said data to said computer as up data.

The transmission step is desirably for substituting the acquired location information for a predetermined character string contained in the down data and transmitting the data to the computer as up data.

According to this invention, the location information of a mobile communication terminal can be supplied to the computer as a standard interface protocol. Also, the advisability of whether the location information of a mobile communication terminal is to be disclosed or not is managed by a mobile communication network, and the security of the location information of the mobile communication terminal can be maintained.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the configuration of an entire system according to a first embodiment of the

present invention.

Fig. 2 is a diagram showing a configuration of a mobile station according to the first embodiment.

Fig. 3 is a data format diagram of the disclosure IP information data base stored in a mobile station according to the first embodiment.

Fig. 4A is a diagram showing an example of the submenu data of HTML format transmitted from an IP server to a mobile station according to the first embodiment.

Fig. 4B is a diagram showing a screen displayed on a mobile station based on the submenu data of HTML format shown in Fig. 4A according to the first embodiment.

Fig. 5 is a block diagram showing a configuration of a gateway server according to the first embodiment.

Fig. 6 is a diagram showing a data format of the location-related information data base of the IP server according to the first embodiment.

Fig. 7 is a flowchart showing the operation of a microcomputer of a mobile station according to the first embodiment.

Fig. 8A is a diagram showing a data format of the location information data base of a mobile station according to the first embodiment.

Fig. 8B is a diagram showing the linear information indicating a road shown in Fig. 8A according to the first embodiment.

Fig. 8C is a diagram showing the spot information indicating the floors in a building shown in Fig. 8A

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according to the first embodiment.

Fig. 8D is a diagram showing a data format of a table included in a mobile station according to the first embodiment.

5 Fig. 9 is a diagram showing a screen displayed on a mobile station according to a modification of the first embodiment.

10 Fig. 10 is a diagram showing a data format of a data base included in a node of a network according to a modification of the first embodiment.

Fig. 11 is a diagram showing a data format of a data base included in a node of a network according to a modification of the first embodiment.

15 Figs. 12A and 12B are diagrams showing a data format of a data base included in a mobile station according to a modification of the first embodiment.

Fig. 13 is a block diagram showing a configuration of a mobile station according to a second embodiment of the invention.

20 Fig. 14 is a block diagram showing a configuration of a gateway server according to the second embodiment.

Fig. 15 is a flowchart showing the operation of the second embodiment.

25 Fig. 16 is a diagram showing an example of a hyper link character string according to a third embodiment of the invention.

Fig. 17 is a block diagram showing a configuration of a gateway server according to the third embodiment.

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Fig. 18 is a diagram showing a data format of an area code table included in a gateway server according to the third embodiment.

Fig. 19 is a flowchart showing the operation of a microcomputer of a mobile station according to the third embodiment.

Figs. 20A and 20B are diagrams showing a data format included in a mobile station according to a modification of the third embodiment.

Figs. 21A and 21B are diagrams showing the screens displayed on a mobile station according to a fourth embodiment of the invention.

Fig. 22 is a flowchart showing the operation of a microcomputer included in a mobile station according to the fourth embodiment.

#### BEST MODE FOR CARRYING OUT THE INVENTION

Embodiments of the present invention will be explained below with reference to the drawings.

The embodiments described below, however, are only an example of the invention, and the present invention can be modified in various ways within the scope of the technical concept thereof.

A: First embodiment

A-1: Configuration of First Embodiment

(1) Configuration of Entire System

Fig. 1 is a block diagram showing a configuration of

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an entire mobile communication system used in the first embodiment.

This mobile communication system comprises a mobile station 101, a mobile telephone network 200, a mobile packet communication network 300, the Internet 400, IP servers 500A, 500B and so on. In this embodiment, the mobile packet communication network 300 and the mobile telephone network 200 are collectively called a mobile communication network.

The mobile station 101 is a mobile communication terminal like a portable telephone or a PHS and receives a speech service of the mobile telephone network and a packet communication service of the mobile packet communication network 300. As shown in Fig. 2, this mobile station 101 includes a radio unit 101a for carrying out the radio communication with a base station of the mobile communication network, a voice input/output unit 101c for causing the user to carry out the voice communication, an information display unit 101d configured of a liquid crystal panel or the like, an operation unit 101e by way of which the operation is performed for inputting information such as numerals and characters, a GPS receiving unit 101f having an antenna and a receiver not shown, and a timer 101g. The mobile station 101 also has built therein a microcomputer 101b for controlling these various parts.

Further, the microcomputer 101b has stored therein software for browsing document data (what is called the browser), acquires data of HTML (Hyper Text Markup Language) (hereinafter referred to as the HTML data) from an

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5           The memory (not shown) built in the microcomputer 101b  
has stored therein the location measuring program and the  
IP information. The location measuring program is for  
measuring the location based on the information contained  
in the radio wave received by the GPS receiving unit 101f,  
10 and the microcomputer 101b calculates the location  
information of the mobile station 101 by executing this  
location measuring program. In the process, the timer 101g  
is used for measuring the time at which the radio wave sent  
from a GPS satellite not shown is received by the GPS  
15 receiving unit 101f.

Also, the memory of the mobile station 101 has stored therein a disclosure IP information data base as shown in Fig. 3. The user of the mobile station 101 checks the service agreement screen supplied by the IP server 500 beforehand, and signs an agreement with the IP server 500 for receiving the location-related information service. Once this agreement is signed, the IP server 500 instructs the mobile station 101 to store the name of the host of the server in the disclosure IP information data base as disclosure IP information, and the mobile station 101 stores the same host name in the disclosure IP information data base in compliance with the instruction. The mobile station 101 determines whether the location information can

be disclosed or not with reference to the disclosure IP information data base. This determination as to whether the location information can be disclosed or not based on the disclosure IP information is in order to prevent the transmission of the location information to an IP server 500 against the will of the user.

As shown in the drawing, the disclosure IP information data base has stored therein a "host name: URL (Uniform Resource Locator)", a "service name" and a "location information disclosure flag" for each "IP server name". Also, the disclosure IP information data base includes a "user permit flag".

The location information disclosure flag is set on for the IP server 500 to which the location information of the mobile station 100 is disclosed (i.e. the IP server 500 capable of acquiring the location information of the mobile station 100).

In the drawing, for example, the IP server 500A and the IP server 500B perform the service of providing the location-related information, and the IP server 500C provides the service of supplying wide area information.

The wide area information is defined as the information having the same contents regardless of the location where the party receiving the information is located, and the wide area information service is the one independent of the location information of the mobile station 100. The wide area information service includes the service of distributing news about the whole country.

SUB #27 The location-related information service, on the other hand, is the one dependent on the location of the mobile station 100 for providing the aforementioned information on restaurants, for example.

5 As shown in the drawing, the IP server 500A and the IP server 500B can acquire the location information (i.e. the location information is disclosed to the IP server 500A and the IP server 500B), and therefore the location information disclosure flag is set in on state for them. The IP server 500C, on the other hand, cannot acquire the location information of the mobile station 100 (i.e. the location information is not disclosed to the IP server 500C), and therefore the location information disclosure flag is set off for the same.

15 The user permit flag is set the same way for all the IP servers 500 to which the location information of the mobile station 100 is disclosed, and set on in the case where the permission of the user of the mobile station 100 is required before the location information is disclosed to

20 the IP server 500A or the IP server 500B for which the location information disclosure flag is set in on state.

SUB #34 Some users may want the information on their location to be unknown to others. In such a case, in order to prevent the location information of the mobile station 100 from

25 being disclosed to the IP servers 500A, 500B and so forth against the will of the user, the user can set the user permit flag on by a predetermined key operation. In the case where the user permit key is set off, on the other hand, the



at intervals in a speech service area, and each base station 210 is assigned a base station ID. The base station 210 performs radio communication with the mobile station 101 located in each radio zone.

5       The switching station 220 accommodates a plurality of base stations 210 for performing the switching operation for the communication lines of the mobile stations 101 located in the radio zone of each base station. The switching station 220 includes a location information table  
10   221 for detecting the mobile stations 101 located in the radio zone of each base station 210 accommodated in the particular switching station 220.

      The home memory 230 has registered therein various information including the subscriber information, the  
15   location registration information, and the billing information as a data base.

      The location registration information indicates an area in the network in which each mobile station 101 is located, and is stored in the location registration data  
20   base 231.

      The mobile packet communication network 300 is for providing the packet communication service to the mobile stations 101, and includes a packet subscriber processing unit 310, a gateway server 330 and a communication line  
25   connecting them in addition to the base station 210, the switching station 220, the home memory 230, etc.

      The packet subscriber processing units 310 are configured of computer systems included in the switching

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station 220, and each packet subscriber processing unit 310 has a unique packet subscriber processing unit ID.

The packet subscriber processing unit 310, at the request of the mobile station 101 for packet switching, confirms the validity of the packet switching request received, and performs the process of packet switching.

The gateway server 330 is a computer system installed in a mobile packet switching station (not shown) for connecting the mobile packet communication network 300 with other networks such as the Internet 400. The gateway server 330 acts as an intermediary for data transmission and reception between a plurality of networks while converting different communication protocols between the plurality of the networks. Specifically, the gateway server 330 converts the transmission protocol for the mobile packet communication network 300 and TCP/IP to each other. TCP/IP is a standard communication protocol for the Internet 400.

Also, the gateway server 330 holds the main menu screen data for presenting the menu of the various services supplied by the IP servers 500A, 500B and so on to the user of the mobile station 101, and transmits these data in compliance with the request from the mobile station 101. These main menu screen data are in HTML format, and each have embedded therein the URL including the names of the hosts of the IP servers 500A, 500B and so on executing the services corresponding to each menu item.

The IP servers 500A, 500B and so on make up a server system operated by the IP and send out the information to

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be supplied to the user, to the Internet 400 as data in HTML format.

According to this embodiment, the IP servers 500A, 500B and so on supply each mobile station 101 with the location-related information corresponding to the location of the mobile station 101, and are equipped with the location-related information data bases 510A, 510B and so on for storing various location-related information. The IP servers 500A, 500B and so on search the location-related information data bases 510A, 510B and so on based on the location information of the mobile station 101 notified from the mobile station 101, and transmit the location-related information obtained as the result of the search to the mobile station 101 through the Internet 400 or the like.

Also, the IP servers 500A, 500B and so on store the submenu screen data in HTML format for presenting to the user the menu of the services to be executed by themselves, and when the mobile station 101 accesses the IP servers 500A, 500B and so on, the submenu screen in store is transmitted to the mobile station 101.

Fig. 4A is a diagram showing an example of the submenu screen data in HTML format to be transmitted to the mobile station 101 by the IP servers 500A, 500B and so on, and Fig. 4B a diagram showing the submenu screen displayed on the mobile station 101 based on the particular screen data.

As shown in Fig. 4B, the submenu items include "restaurant information", "movie theater information", "art museum information" and "follow-up information supply



In the case where the user selects the "restaurant information" from the submenu screen shown in Fig. 4B, for example, the hyper link character string (refer to Fig. 4A) "http://xxx.co.jp/cgi-bin/restaurant.cgi?area=NULLAREA" embedded in the "restaurant information" is transmitted from the mobile station 101 to any one of the IP servers 500A, 500B and so on indicated by the host name "xxx.co.jp" through the gateway server 330 or the like.

The data string "NULLAREA" is contained in the last part of the hyper link character string. This data string "NULLAREA", which is substituted for by the location information of the mobile station 101 in the mobile station 101 and transmitted to the IP servers 500A, 500B and so on indicated by the host name, will hereinafter be referred to as the "location information substitution data string".

## (2) Configuration of Gateway Server 330

Fig. 5 is a block diagram showing a configuration of the gateway server 330.

This gateway server 330 is configured of an interface unit 321, a subscriber information management unit 322, a



data distribution management unit 323, a bus 326 for connecting them to each other, etc.

The interface unit 321 performs such functions of an interface between the networks as the protocol conversion  
5 between the mobile packet communication network 300 and the Internet 400 or other networks.

The subscriber information management unit 322 stores and manages the subscriber information obtained with reference to the home memory 230 described above.

10 The data distribution management unit 323 manages the data distribution processing between the mobile stations 101, between each mobile station 101 and the Internet 400 or other networks, or between each mobile station 101 and the IP servers 500A, 500B and so on.

15 Also, the data distribution management unit 323 stores the main menu screen data described above, and transmits the screen data to the mobile stations 101 in accordance with the request signal from the mobile station 101. The main menu items, for example, include the "location-related  
20 information service" for providing the information related to the location of the mobile station 101 and the "news distribution service" for distributing news.

The IP servers 500A, 500B and so on can be accessed by the mobile station 101 according to either of two methods  
25 including a method in which the user selects the desired main menu item from the main menu screen displayed on the mobile station 101 and a method in which the user directly inputs the URL of the desired one of the IP servers 500A,

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500B and so on using the keypad of the mobile station 101.

In the case where the user selects the desired main menu item from the main menu screen displayed on the mobile station 101, the mobile station 101 transmits to the gateway server 330 the request signal including the URL embedded in the particular main menu item, and the data distribution management unit 323 of the gateway server 330 accesses one of the IP servers 500A, 500B and so on based on the host name of the URL contained in the request signal thus received.

In the case where the user directly inputs the URL of one of the IP servers 500A, 500B and so on he/she wants to access in the mobile station 101, on the other hand, the mobile station 101 transmits the input request signal containing the URL to the gateway server 330, and the data distribution management unit 323 of the gateway server 330 accesses one of the IP servers 500A, 500B and so on based on the host name of the URL contained in the request signal received.

Once the mobile station 101 accesses the IP servers 500A, 500B and so on by any one of the methods described above, the IP servers 500A, 500B and so on transmit the submenu screen stored therein to the mobile station 101.

(5) Configuration of Location-Related Information Data Base 510

Fig. 6 shows a diagram showing the format of the location-related information data bases 510A, 510B and so on included in the IP servers 500A, 500B and so on,

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respectively.

The location-related information data bases 510A, 510B and so on have stored therein the "area code" for each area, the "area name" and the "location-related information" corresponding to the area code.

The areas can be classified using one of various standards including the administrative classification of the municipalities, the postal code and the latitude/longitude. In the drawing, the area code "CODE001" indicates "1-chome, Shibuya-ku" which is an administrative classification, and the information including the "building name" such as the "restaurant", the "movie theater", the "art museum", etc. located at 1-chome, Shibuya-ku, the "address", the "telephone number" and the "event" are stored in the location-related information data base 510.

#### A-2: Operation of First Embodiment

Now, the operation of the first embodiment having the aforementioned configuration will be explained with reference to the flowchart shown in Fig. 7.

First, the user selects the desired main menu item from the main menu screen displayed on the mobile station 101, or directly inputs the URL of the desired one of the IP services 500A, 500B and so on in the mobile station 101. The mobile station 101 thus accesses one of the IP servers 500A, 500B and so on (for the present purpose, we assume that the IP server 500A (host name: xxx.co.jp) is accessed)

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corresponding to the particular menu item. Then, the IP server 500A, in response to the access from the mobile station 101, transmits the submenu screen data (the screen data shown in Fig. 4A, for example) in store to the mobile station 101 through the gateway server 330. When the mobile station 101 receives the particular submenu screen data, the microcomputer 101b displays the submenu screen (Fig. 4B) on the information display unit 101d based on the received data and starts the processing shown in Fig. 7.

From the submenu screen displayed on the information display unit 101d, the user selects the desired menu item by key operation. The process of the microcomputer 101b proceeds to step Sa1, and the key operation is accepted. We assume that the menu item "restaurant information", for example, has been selected from the menu shown in Fig. 4B.

Then, at step Sa2, the microcomputer 101b determines whether the location information substitution data string "NULLAREA" is contained or not in the hyper link character string embedded in the selected menu item. In this case, as shown in Fig. 4A, the hyper link character string is "http://xxx.co.jp/cgi-bin/restaurant.cgi?area=NULLAREA", and therefore the determination in step Sa2 is YES, and the process proceeds to step Sa3.

In the case where the location information substitution data string is not contained in the hyper link character string, on the other hand, the process proceeds to step Sa4 to transfer to the process corresponding to the selected menu item, which is not related to the present

In step Sa3, it is determined with reference to the disclosure IP information data base (Fig. 3) whether the IP server 500A constituting the destination of transmission of the location information is the destination to which the location information of the mobile station 101 is disclosed or not. Specifically, it is determined whether the location information disclosure flag of the disclosure IP information data base is set in on state for the host name (URL) in the hyper link character string. In the case under consideration, the location information disclosure flag of the disclosure IP information data base is assumed to be set in on state for the host name "xxx.co.jp", and the process proceeds to step Sa3a.

If the user permit flag is set on, the user permission is required in advance. Therefore, the transmission permit screen for obtaining the user permission to transmit the

location information is displayed on the information display unit 101d in step Sa5. This is the process performed taking into consideration that the user may not want to transmit the location information even to the IP server 500 registered as a destination to which the location information can be disclosed. In this way, whether the user is willing or not to transmit the location information is confirmed each time the mobile station 101 tries to transmit the location information.

After the key operation of the user to determine whether the user permits the transmission of the location information or not, the process proceeds to step Sa6 to determine whether the transmission of the location information is permitted or not. In the case under consideration, it is assumed that the transmission is permitted by the key operation, and the process proceeds to step Sa7.

In step Sa7, the microcomputer 101b receives the radio waves sent from at least three GPS satellites by activating the GPS receiving unit 101f. Then, the location measuring program is started thereby to generate the location information of the mobile station 101 based on the radio waves.

Specifically, the radio wave transmitted from each GPS satellite contains the ID information of the GPS satellite and the time at which the particular radio wave is transmitted. The microcomputer 101b reads from the timer 101g the time point at which the radio wave is received,

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and from the difference between the time point at which the radio wave is transmitted and the time point at which it is received, calculates the distance from the GPS satellite by which the radio wave is transmitted, to the mobile station 101. This process is performed for each of the radio waves transmitted from at least three GPS satellites so that the distance from each of these GPS satellites to the mobile station 101 is calculated. The location of each GPS satellite is known, and therefore the location at the calculated distance from the location of each GPS satellite is determined as the location information of the mobile station 101.

In this way, we assume that the location information of, say, "N35.43.21.99E141.43.21.99" is generated.

Then, the process proceeds to step Sa8, in which the location information substitution data string "NULLAREA" in the hyper link character string is substituted for by the generated location information "N35.43.21.99E141.43.21.99".

The process proceeds to step Sa9, in which a request signal containing the hyper link character string "http://xxx.co.jp/cgi-bin/restaurant.cgi?area=N35.43.21.99E141.43.21.99" is generated, and transmitted to the IP server 500A through the gateway server 330. The IP server 500A starts the location-related information application in response to the request signal thus received, reads, from the location-related information data base 510A, the

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location-related information (restaurant information) corresponding to the location information "N35.43.21.99E141.43.21.99" contained in the signal and transmits the same location-related information to the mobile station 101 through the Internet 400 based on the mobile station ID contained in the request signal.

In step Sa10, the mobile station 101 receives the location-related information through the gateway server 330, and the microcomputer 101b displays the received location-related information on the information display unit 101d thereby to end the process.

In the above-mentioned example, on the other hand, we assume that the IP server 500 to which the location information is to be transmitted is not the destination of disclosure of the location information of the mobile station 101. The determination in step Sa3 is NO. Therefore, the process proceeds to step Sa11 so that the transmission of no location information is displayed on the information display unit 101d thereby to end the process. Also, in the case where the user indicates by key operation that he/she gives no permission of transmission, the determination in step Sa6 is NO, and therefore the process proceeds to step Sa11, in which the transmission of no location information is displayed on the information display unit 101d thereby to end the process.

#### A-3: Modification of First Embodiment

The first embodiment can be modified, for example, in



the following way:

(1) GPS variations

According to the first embodiment, it was explained that the timer 101g counts the time points at which the radio waves sent from at least three GPS satellites are received. However, the mobile station 101 is not always required to be equipped with the timer 101g. Specifically, the timer 101g is not required as long as the mobile station 101 receives the radio waves sent out from four GPS satellites, or holds the data indicating the geoid surface, i.e. a curved surface reproducing the ups and downs of the earth surface.

(2) Forms of IP servers 500A, 500B and so on

According to the first embodiment described above, the IP servers 500A, 500B and so on are connected to the gateway server 330 through the Internet 400. The connection, however, is not necessarily limited to such a form.

The IP servers 500A, 500B and so on may be connected, for example, to the gateway server 330 through a dedicated line or may be arranged in the mobile communication network.

Also, unlike in the first embodiment, the IP servers 500A, 500B and so on are not necessarily required to have the function to supply some information to the mobile station 101, but they may be a simple computer, or a portable telephone which can be movably carried or a PDA with communication and self-location measuring functions.

(3) Form of location information substitution data string

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or mobile station ID substitution data string

In the first embodiment described above, the location information substitution data string "NULLAREA" is added to the last part of the hyper link character string contained in the request signal. This is not always necessary, but the substitution data string can be contained at a predetermined location in the request signal transmitted from the mobile station 101. Also, the data string is not necessarily the character string such as "NULLAREA" or "NULLID", but other character strings.

#### (4) Description format of location information

In the first embodiment described above, by converting a predetermined character string into location information, the particular location information can be supplied to various IP servers.

The invention, however, is not limited to this, but it is only necessary that the description format of the location information is coincident between the mobile station 101 and the IP servers 500A, 500B and so on. Specifically, the IP servers 500A, 500B and so on notify the description format of the location information to the mobile station 101 in advance, so that the location information is described by the mobile station 101 based on the notified format, and transmitted to the IP servers 500A, 500B and so on.

The processing for notification of the description format of the location information described above includes

the following, for example. First, the IP servers 500A, 500B and so on describe the description format of the location information in a predetermined file, and transmit it to the mobile station 101 with a specific extension indicating that the file is for designating the description format of the location information. The mobile station 101 acquires the description format of the location information with reference to the contents of the file.

10 (5) Form of mobile station 101

According to the first embodiment described above, the mobile stations such as the portable telephone and PHS are used as a mobile station. The invention is not limited to them, however, but may use such a mobile communication terminal as the PDA having the function of communication and self-location measurement as long as it has the function of radio communication of data with the base station 210 of a mobile communication network.

20 (6) Data description language

According to the first embodiment described above, the data transmitted and received between the gateway server 330 or the servers 500A, 500B and so on and the mobile station 101 are of HTML format. The invention is not limited to it, however, but other description languages such as XML (Extensible Markup Language) are also applicable.

(7) Type of information notified to IP servers 500A, 500B

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and so on

According to the first embodiment described above, only the location information is supplied to the IP servers 500A, 500B and so on. The invention is not limited to it, however, but such information as the location information acquisition time and the user state (moving, meeting or staying in home, etc.) may be attached to the information and notified to the IP servers 500A, 500B and so on.

For this purpose, the IP servers 500A, 500B and so on wanting to acquire the location information acquisition time and the user state in addition to the location information make sure that the hyper link character string to be transmitted to the user mobile station 101 contains the data string to be converted to such information.

For example, the hyper-link character string can be described in the following manner.

"http://xxx.co.jp/cgi-bin/posi.cgi?area=NULLAREA&time=NULLTIME&state=NULLSTATE"

where "NULLAREA", "NULLTIME" and "NULLSTATE" are the character strings to be substituted for by the location information, the location information acquisition time and the user state, respectively. Hereinafter, "NULLTIME" will be referred to as "the location information acquisition time substitution data string" and "NULLSTATE" "the user state substitution data string".

The "user state" can be designated by either of two methods, one by determining the user state based on the

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location of the mobile station 101 indicated by the location information generated by itself and substituting the user state for the character string "NULLSTATE" automatically, and the other by causing the user of the mobile station 101 to select the present state of the user from a predetermined menu by input operation in the mobile station 101 and substituting the selected information for the character string "NULLSTATE".

More specifically, according to the first method, upon detection of the location information substitution data string "NULLAREA" and the location information acquisition time substitution data string "NULLTIME" from the hyper link character string received by the mobile station 101, the microcomputer 101b measures the location of itself by executing the program for measuring the location of itself according to a method similar to that for the embodiment described above. The resulting location information and the location measuring time information are substituted for the character strings of "NULLAREA" and "NULLTIME", respectively. The procedure up to this point is the same as that up to step Sa8 shown in Fig. 7.

After that, the microcomputer 101b of the mobile station 101 determines whether the user state substitution data string "NULLSTATE" is contained in the hyper link character string received.

In the case where this determination is YES, the microcomputer 101b accesses the location information data base as shown in Fig. 8A. This location information data

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base has stored therein a table describing the location information specified by the latitude (x), the longitude (y) and the altitude (Z) and the corresponding information representing the artificial objects or natural objects occupying the respective locations (hereinafter referred to as the occupant information). The occupant information includes the category and the name of the occupant and is stored in terms of "category/occupant name" such as "Expressway/Tomei Expressway", "Shopping/xxx Tower Shopping Floor" and "Restaurant/xxx Tower Restaurant".

The location information is expressed in either of two forms. The first form of expression is a combination of linear information and allowance. The location information based on the first form of expression is used for specifying the location of an area occupied by an artificial object such as a road or railroad which extends in curved form in the space. With reference to Fig. 8B, the first form of expression will be explained. In Fig. 8B, the spatial curve plotted by the central portion of a given road is segmented into a plurality of straight lines p0-p1, p1-p2, p2-p3 and so on. As shown in Fig. 8A, the location information corresponding to the road includes the linear information corresponding to each of the straight lines p0-p1, p1-p2, p2-p3 and so on. Each linear information is expressed by the three-dimensional coordinate values (latitude x, longitude y and altitude z) of the two ends (point p0 and point p1 of straight line p0-p1, for example) of a straight line corresponding to the

particular linear information. Also, as illustrated in Fig. 8B, each section of the road has a transverse expansion such as  $\Delta 0$  for the section of the road corresponding to the straight line p0-p1,  $\Delta 1$  for the section corresponding to the straight line p1-p2, and so on. A person, if located within the range of the transverse expansion from the central portion of the road, can be said to be located on the particular road. As shown in Fig. 8A, the location information corresponding to the road contains an allowance for each section of the straight lines p0-p1, p1-p2, p2-p3 and so on, and each allowance represents the transverse expansion (displacement from the center) of a corresponding road section. The mobile station 101, once the three-dimensional coordinate values (latitude x, longitude y and altitude z) of the present location thereof is obtained, refers to a set of a plurality of linear information and allowances corresponding to the road and can determine whether the mobile station 101 is located in the space expressed by the information set, i.e. on the particular road.

The second form of expression is a combination of spot information and the allowance. The location information based on the second form of expression is used for specifying the location of an occupied area such as a building or a floor in the building. The location information based on the second form of expression includes the spot information indicating a representative point of the floor and an allowance indicating the expansion of the floor from the

representative point as a center. For example, a building and a plurality of floors in the building are plotted in Fig. 8C. In this case, the location information corresponding to each floor, as shown in Fig. 8A, includes the spot information indicating the three-dimensional coordinate values (latitude x, longitude y and altitude z) of the representative points q0, q1 and so on of each floor and the allowance indicating the expansion from the representative point of each floor (for example, r0, r1 and so on, in Fig. 8C). The mobile station 101, once the three-dimensional coordinate values (latitude x, longitude y and altitude z) of the present location are obtained, accesses the set of a plurality of spot information corresponding to the respective floors and the allowances and can determine whether the mobile station 101 is located in any one of the floors indicated by the information set.

In some cases, however, the three-dimensional coordinate values cannot be obtained but the two-dimensional values not including the altitude may be obtained as the present location. The location data base shown in Fig. 8A presupposes such a case and has the location information for the whole building.

Further, the mobile station 101 has a user state substitution table in store as shown in Fig. 8D. This table contains categories and corresponding user states, respectively. The mobile station 101, when determining a category of the occupant information from the present location thereof, determines the character string



indicating the corresponding user state from this user state substitution table. Specifically, we assume that the present location of the mobile station 101 is "location (latitude x, longitude y and altitude z)". Also, we assume that the microcomputer 101b searches the location information data base (Fig. 8A) for the location information with the "location (latitude x, longitude y and altitude z)" thereof which falls into the allowance, and that the location information "line p0-p1" has been specified. From Fig. 8A, the occupant information for "line p0-p1" is "expressway/Tomei", and therefore by referring to the table of Fig. 8B, the category "expressway" of the occupant information is converted to the user state "MOVING".

In the case where "NULLSTATE" is not contained in the hyper-link character string received, on the other hand, only the required information other than "user state", which in this case are the location information and the location information acquisition time information, are transmitted to the IP servers 500A, 500B and so on.

In the second method of designating the "user state", the mobile station 101 detects the "user state" by receiving the present state of itself, by a key operation by its user, and substitutes the information thus obtained for the character string "NULLSTATE".

First, as in the first method described above, the microcomputer 101b determines whether the user state substitution data string "NULLSTATE" is contained in the received character string or not. In the case where the

determination is YES, the screen for prompting the user to set the present state is displayed on the information display unit 101d as shown in Fig. 9. The items under the title "state" include "meeting", "moving in car", "moving in train" and "in home". These items are displayed in a different order for a different frequency of selection, the item of the highest frequency of selection being displayed at the top. The user of the mobile station 101 selects and inputs the desired item by key operation through the operation unit 101e by reference to Fig. 9.

Assume, for example, that the user has selected the item "moving in car". The microcomputer 101b that has received this information generates the data character string "MOVING" to be substituted for the user state substitution data string "NULLSTATE".

In this way, the information indicating the "user state" thus generated is substituted for "NULLSTATE", so that the up data string described below is transmitted to the IP servers 500A, 500B and so on.

"http://xxx.co.jp/cgi-bin/posi.cgi?area=N35.716931E141.722775&time=20010208153344.5+0900&state=MOVING", where "N35.716931E141.722775" is the data indicating the location of the mobile station 101, "20010208153344.5+0900" the data indicating the location information acquisition time, and "MOVING" the data indicating the user state.

In this second method, the user is prompted to input information after the mobile station 101 detects the

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character string "NULLSTATE". Nevertheless, the user can alternatively set the state in advance. Also in such a case, by the same method as described above, the user can select the state on the screen of the mobile station 101.

5 According to this method in which the "user state" is input in advance, the input operation is performed before the notification requesting the acquisition of information from the computer is transmitted to the mobile station 101, and therefore the burden on the user performing the input  
10 operation is reduced while at the same time shortening the time required for sending information in response.

With a configuration of the mobile station 101 having neither the information display unit 101d nor the operation unit 101e, on the other hand, the mobile station 101 can  
15 be connected to a personal computer or the like arbitrary terminal from which the state of the mobile station 101 can be written in the memory (not shown) of the mobile station 101.

In this case, when the mobile station 101 receives the  
20 hyper link character string containing the character string "NULLSTATE", the user state generated in advance is substituted for "NULLSTATE".

By the method described above, the IP servers 500A, 500B and so on can acquire not only the location information  
25 but also the location information acquisition time and the user state at the same time.

(8) Form of place for storing information on destination

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of disclosure and form of information

According to the first embodiment, the information on whether the IP server of the destination of disclosure is involved or not is stored in the memory of the mobile station 101. This information may alternatively be stored in another node in the network and accessed by the mobile station 101 to refer to the information each time a request is received to disclose the location information. As a result, the burden on the memory of the mobile station 101 is reduced, and the deterioration of performance of the multifunctional mobile communication terminal can be prevented to allow the execution of various programs within a limited memory.

Another node in the network may be a relay center such as a gateway server 330 or a server managed by the company providing a service for privacy protection such as a security firm. Also, a single node or a plurality of nodes may be involved, and the mobile station 101 can register the destination information at an arbitrary place desired by itself.

As a precondition, the mobile station 101 is to register, in advance, the information of the destination to which the location information of itself is disclosed, by accessing the nodes or by a method in which the carrier of the mobile communication network is notified and, based on the notification, registers the name of the IP server to be disclosed, in the data base at a predetermined place.

The registered information on the destination of

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disclosure can take such a form as to set, for each mobile station 101, the IP servers 500A, 500B and so on to which the location information is to be disclosed. Fig. 10 shows an example of a data format of the data base included in a node. As shown in Fig. 10, the "IP server name" to which the location information is to be disclosed is registered in the data base for each "mobile station ID". The location information of the mobile station ID "MS0901111111" shown in Fig. 10, for example, is permitted to be disclosed to the "IP servers 500A, 500D, 500H, and so on". It is determined that the location information is not disclosed to the IP servers 500 not registered in this data base.

The location information of a specific mobile station 101 can be set not to be disclosed. Fig. 11 shows an example of a data format of the data base included in a node in a network in such a case.

The information to be disclosed can take an arbitrary different form for a different node in which the information on the destination of disclosure is stored.

As described above, according to this method, the information on the destination of disclosure can be stored by the user in an arbitrary node in the network. At the same time, in the node for storing the information on the destination of disclosure, the information on the destination of disclosure can be stored in a form which meets various needs of the user who wants the location information to be known to a specific IP server 500 only or who never wants the location information to be known to any server.

101.

- 5 (9) Transmission of location information, etc. to a plurality of IP servers 500A, 500B and so on

According to the first embodiment described above, the location information or the like is transmitted to a single IP server 500. The location information or the like, however, may be notified not necessarily to a single destination but to a plurality of IP servers 500A, 500B and so on.

We assume that the IP server 500A coordinates the acquisition of the location information for a plurality of destinations of notification (which are assumed to be IP servers 500A, 500B, and 500C, in this case).

First, the IP server 500A generates, in advance, the following down data designating a plurality of destinations of notification to which the location information is to be transmitted, and transmits the data to the mobile station 101:

```

"http://xxx.co.jp/cgi-
bin/manager.cgi?area=NULLAREA&time=NULLTIME&state=NULLS
TATE&HOST1=http://aaa.co.jp/cgi-
25 bin/posi.cgi?area=NULLAREA&HOST2=http://bbb.co.jp/cgi-
bin/posi.cgi?area=NULLAREA&time=NULLTIME".

```

The microcomputer 101b of the mobile station 101 that has received this data string recognizes, from a

predetermined key word, i.e. the character string "HOST", that a plurality of destinations of notification are included in the data string and divides the data character string before (or after) the key word "HOST" by the destination of notification.

As a result, the data character string received by the mobile station 101 is divided into three parts including the data string corresponding to the IP server 500A, i.e. "http://xxx.co.jp/cgi-bin/manager.cgi?area=NULLAREA&time=NULLTIME&state=NULLSTATE"; the data string corresponding to the IP server 500B, i.e. "http://aaa.co.jp/cgi-bin/posi.cgi?area=NULLAREA"; and the data string corresponding to the IP server 500C, i.e. "http://bbb.co.jp/cgi-bin/posi.cgi?area=NULLAREA&time=NULLTIME".

Then, the mobile station 101, after performing the operation for acquiring the location information as explained in the first embodiment, substitutes the data such as the location information, the location information acquisition time and the user state as of the time of acquisition, respectively, for the character strings "NULLAREA", "NULLTIME" and "NULLSTATE" contained in each data string. An example of the data after substitution is as follows:

a) Data string transmitted to IP server 500A

"http://xxx.co.jp/cgi-bin/manager.cgi?area=N35.716931E141.722775&time=2001020

8153344&state=MEETING"

b) Data string transmitted to IP server 500B

"http://aaa.co.jp/cgi-

bin/posi.cgi?area=N35.716931E141.722775"

5 c) Data string transmitted to IP server 500C

"http://bbb.co.jp/cgi-

bin/posi.cgi?area=N35.716931E141.722775&time=2001020815  
3344"

10 The mobile station 101 transmits these up data strings  
independently of each other to the computers of different  
destinations, and thereby can provide the required  
information such as the location-related information to a  
plurality of destinations of notification.

15 Also, by use of this method of notification to a  
plurality of destinations, the location of the user of the  
mobile station 101 can be notified not only to a plurality  
of IP servers but to a plurality of mobile or stationary  
terminals. This is useful, for example, in the case where  
an entertainment idol supplies his/her present location  
20 information to the (mobile or stationary) terminals held  
by a plurality of the members of his/her fan club, using  
the mobile station 101.

In such an application as mentioned above for  
providing the members of a fan club with the information,  
25 however, the destinations of notification are often too many,  
and therefore the problem may be posed that the requirement  
cannot be met by the method described above in which the  
destinations of notification are designated by including

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a plurality of destinations of notifications in the hyper link character string.

In view of this, a method has been made available in which a group of destinations of notification are designated  
5 by those acquiring the location information, using a program for managing the telephone numbers of the destinations of communication by group, i.e. a telephone directory, such as is normally installed at a mobile communication terminal.

This method will be explained below taking as an  
10 example the case in which the present location information of an entertainment idol is transmitted to the terminals of the members of his/her fan clubs. First, the telephone numbers of destinations of notification are registered by group in the form shown in Fig. 12A in the memory (not shown)  
15 of the mobile station 101 of the entertainment idol who provides the location information. As shown in the drawing, a multiplicity of destinations of notification are registered in groups 00 to n. Each group corresponds to a fan club. Group 01, for example, includes the information  
20 on destinations of notification such as the telephone numbers, mail addresses, fax numbers and home addresses of the terminals B, C and D of the fans belonging to a given fan club.

The mobile station 101, upon receipt of a request from  
25 another terminal for transmission of the present location information, transmits the present location information to each destination of notification belonging to the group designated by the particular request. According to this

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embodiment, however, as shown in Fig. 12B, a table specifying, by group, parties from whom the transmission request is received for actual transmission of the present location information is stored in the mobile station 101, which determines, based on the table, whether a given transmission request is to be accepted or not.

This method will be described in more detail. First, we assume that a person associated with a fan club corresponding to group 01 desires to receive the distribution of the location information of an idol. The terminal A of the person transmits to the mobile station 101 a hyper link character string containing the data string designating an arbitrary group to be notified, thereby requesting that the location information of the mobile station 101 be transmitted to the addresses (terminals B, C and D, for example) belonging to the designated group 01 to be notified.

In this case, the terminal A can transmit the following hyper link character string to the mobile station 101 of the idol:

```
"<IMG                                SRC="cti-pos://--
-.sposi/posi.cgi?req=09012345679&group=01&area=NULLAREA
&state=NULLSTATE>"
```

where the group number 01 to be notified is designated by the character string "group=01". Also, "req=09012345679" indicates the telephone number of the terminal A as an ID code of the terminal A requesting the transmission of the location information. This ID code is not necessarily the

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telephone number but may be a mail address, a fax number or the information such as a home address contained in the telephone directory by which the terminal A can be identified.

5       The microcomputer 101b of the mobile station 101 of the idol that has received this hyper link character string first identifies the transmitter terminal based on the ID code described above. In the case under consideration, it is assumed that the terminal A has been identified by  
10       referring to the telephone directory stored in the memory based on the telephone number "09012345679". In the case where the mobile station 101 cannot identify the transmitter terminal, i.e. in the case where the request to notify the location information is from a terminal not registered in  
15       the telephone directory of the mobile station 101, then the processing in the mobile station 101 is terminated at this point.

Then, the microcomputer 101b of the mobile station 101 determines, by referring to the "destination group  
20       accessibility table" (Fig. 12B) stored in the memory, whether the terminal A can utilize the destination data of "communication destination group 01" or not.

The "destination group accessibility table", as shown in Fig. 12B, has registered therein, by destination group,  
25       whether each terminal can access the destination information of the particular group or not. This table shows that the terminal A can access the data of the destination group 01.

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In the case where the transmitter is the terminal E, on the other hand, the data of the group 01 is not accessible. In such a case, a notice disapproving the communication may be transmitted by returning directly, without substitution, the data string transmitted from the terminal E.

Again, we assume that the transmitter terminal is the terminal A. The mobile station 101 of the idol, after substituting the requested data such as the location information, first transmits the substituted data string to the terminal A.

```
"<IMG SRC='cti-pos://--
..sposi/posi.cgi?req=09012345679&group=01&area=N35.7169
31E141.722775&state=ONAIR-TBS>"
```

After transmitting this data string, the mobile station 101, by referring to the destination list (Fig. 12A) of group 01 stored beforehand, retrieves the data on the destination secondary to the primary destination in the list, i.e. the mail address of the terminal B in the case under consideration. Then, the data string to be sent to the terminal B is generated.

An example of the data string transmitted to the terminal B is as follows:

```
"<IMG SRC='cti-pos://--
..sposi/posi.cgi?type=U&subject=ONAIR-
TBS&address=09012345678@aaa.com&body=http://mapserv.map
fan.com/cgi-
bin/map/mapserv.cgi?MAP=E141.722775N35.71693&ZM=9&SZ=12
0,120&OPT=30500011&P=eE141.722775N35.716931''>"
```

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By this method, the mobile station 101 acquires the secondary destinations of the terminals of all the primary destinations registered in the destination list of the destination group 01, and can transmit the location information of the mobile station 101 continuously to each of the secondary destinations.

This method of designating the destination group utilizing the function of the telephone directory, as compared with the method of designating destinations by listing a multiplicity of destinations in a single character string, makes it possible to request the transmission of the location information to a multiplicity of destinations without excessively increasing the traffic while at the same time reducing the communication cost.

(10) Transmission of location information, etc. at regular time intervals

In the first embodiment described above, the information requested are transmitted to the IP servers 500A, 500B and so on, only once at the time of receiving the hyper link character string requesting the transmission of the location information, etc. As an alternative, the mobile station 101 may acquire and transmit the location information, etc. to the IP servers 500A, 500B and so on, at regular time intervals.

In the case where the IP servers 500A, 500B and so on are desirous of acquiring the information such as the location information, the location information acquisition

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time and the user state at regular time intervals, such as in the case where they are desirous of tracking a moving object in a bus operation control, for example, the mobile station 101 can be instructed to acquire and transmit the location information, etc. at regular time intervals by transmitting a hyper link character string designating a regular notice to the mobile station 101 from the IP servers 500A, 500B and so on.

In such a case, the character string "cycle=X" (X: value of acquisition interval time) for designating the intervals of the acquisition time and the character string "start=Y&end=Z" (where Y is the acquisition start time, and Z the acquisition end time) for designating the acquisition start time and the acquisition end time are added to the hyper link character string to be transmitted to the mobile station 101 from the IP servers 500A, 500B and so on, in the following manner:

"http://xxx.co.jp/cgi-bin/posi.cgi?cycle=10&start=080000&end=170000&area=NULL AREA&time=NULLTIME&state=NULLSTATE".

The mobile station 101 that has received this character string is instructed to acquire the location information of itself, the location information acquisition time and the state of itself every ten seconds during the time from 8 o'clock to 17 o'clock, and each time the information is acquired, transmit it to the IP servers 500A, 500B and so on.

As an alternative, the mobile station 101, without

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transmitting the information acquired at regular time intervals directly, can be instructed to store them in the mobile station 101 and transmit them collectively at a designated time point. In that case, the hyper link character string is as follows:

"http://xxx.co.jp/cgi-bin/posi.cgi?cycle=10&interval=1h&start=080000&end=170000&area=NULLAREA&time=NULLTIME"

where by adding the character string "interval=1h", an instruction is given to transmit, every hour, the information acquired every ten seconds, during the period from 8 o'clock to 17 o'clock.

The mobile station 101 that has received any of the hyper link character strings described above is set to return the requested information at the timing requested by the IP servers 500A, 500B and so on.

In this case, in compliance with the request indicated by the character string described above, the location information acquired every ten seconds is stored temporarily in the memory in the mobile station 101. The location information data in a plurality of time series thus stored and the location information acquisition time thereof are transmitted collectively one hour later to the destination IP servers. Specifically, a method is available in which the substituted character strings "http://xxx.co.jp/cgi-bin/posi.cgi?area=N35.716931E141.722775&time=20010208153344" in the same number as stored are transmitted

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in a row. According to this method, a plurality of sets of the location information data and the location information acquisition time data acquired during one hour are all transmitted with the character string

5 "http://xxx.co.jp/cgi-bin/posi.cgi?" attached at the head thereof.

A second method is such that the character string "http://xxx.co.jp/cgi-bin/posi.cgi?" is used only once for the first set of the location information data and the

10 location information acquisition time data, and the remaining data are continuously described and sent immediately following the first set. According to the second transmission method, an example of a specific transmission character string is as follows:

15 "http://xxx.co.jp/cgi-bin/posi.cgi?area=N35.716931E141.722775&time=20010208153344&area=N35.716931E141.723800&time=20010208153354&area=N35.716931E141.724800&time=20010208153404&...."

20 Also, by use of the method of notifying the location information to a plurality of destinations described above in the modification (9), a request can be made to notify a plurality of destinations of the location information at regular time intervals.

25 In such a case, the IP server 500A for coordinating the correlated computers transmits the following hyper link character string to the mobile station 101:

"http://aaa.co.jp/cgi-

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• 5

In this case, the mobile station 101 is requested to notify the location information of itself, the location information acquisition time and the user state every second to "aaa.co.jp" (assumed to be the URL of the IP server 500A).

10

The return up data string to the received data string is as follows:

25

bin/posi.cgi?cycle=10&area=N35.716931E141.722775" for every ten seconds; and "http://ccc.co.jp/cgi-bin/map.cgi?cycle=60&area=N35.716931E141.722775&time=NU LLTIME20010208153344.5" for every 60 seconds.

5 This method makes it possible to transmit the location information of the mobile station 101 to one or a plurality of destinations at regular time intervals.

(11) Operation of mobile station 101 when location  
10 information is not disclosed

According to the first embodiment described above, in the case where the computer constituting a data transmitter (assumed to be the IP server 500A in this case) is not the destination to which the location information is to be  
15 disclosed or in the case where the user of the mobile station 101 rejects the transmission of the location information, the absence of transmission of the location information is displayed on the information display unit 101d of the mobile station 101 in step Sa11 shown in Fig. 7 thereby to end the  
20 process. As an alternative, a location information

transmission rejection notice indicating the rejection of transmission of the location information may be transmitted to the IP server 500A in step Sa13 before ending the process.

This location information transmission rejection  
25 notice can be carried out by returning the information such as the location information requested by the IP server 500A without any substitution in the received data string.

Assume, for example, that the mobile station 101 has

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received the received data string  
"http://xxx.co.jp/cgi-  
bin/restaurant.cgi?area=NULLAREA&time=NULLTIME&state=NU  
LLSTATE".

5 Normally, the character strings such as "NULLAREA",  
"NULLTIME" and "NULLSTATE" are returned to the disclosure  
destination IP servers by being substituted for by the  
information such as the location information, the location  
information acquisition time and the state as of the time  
10 of acquisition. In the case where the disclosure is  
rejected, however, the rejection is displayed by "not  
substituting" these data strings. That is to say, the data  
string transmitted from the mobile station 101 to the IP  
server 500A is expressed as

15 "http://xxx.co.jp/cgi-  
bin/restaurant.cgi?area=NULLAREA&time=NULLTIME&state=NU  
LLSTATE".

The IP server 500A, by receiving this data string "not  
substituted", recognizes that the acquisition of the  
20 location information of the mobile station 101 has been  
rejected.

Also, by receiving this transmission rejection notice,  
the IP server 500A can discriminate the case in which no  
data is returned from the mobile station 101, for example,  
25 the case in which the mobile station 101 is located outside  
the communication range and the connection with it cannot  
be established.

As another alternative, in the case where the location

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information cannot be transmitted, the mobile station 101 may substitute a predetermined key word meaning that the transmission is impossible (hereinafter referred to as the error key word) for the location information substitution data string "NULLAREA" and transmit it to the IP servers 500A, 500B and so on.

B: Second Embodiment

Now, a second embodiment of the invention will be explained.

According to this second embodiment, unlike in the first embodiment, the location information is not generated by the mobile station 101 alone, but in collaboration between the mobile station 101 and a predetermined node in the mobile communication network.

Specifically, the mobile station 101, upon receipt of the radio waves sent out from GPS satellites, transfers the information contained in the radio waves, i.e. the identification (ID) information of the GPS satellites and the time at which the radio waves are sent out, plus the time at which the radio waves are received, to a predetermined node in the mobile communication network. The information including the ID information of the GPS satellites, the time at which the radio waves are sent out and the time at which the radio waves are received will hereinafter be collectively referred to as the GPS information. Instead of the time at which the radio waves are sent out and the time at which the radio waves are

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received, however, the difference between these two time points can be used.

The predetermined node in the network, on the other hand, calculates the location information based on the GPS information received from the mobile station 101. The location measuring means in which the mobile station 101 only receives the radio waves sent out from the GPS satellites and the location information is calculated by a node in the network in this way is hereinafter referred to as the network-type GPS.

The node may be any of the devices including the base station 210, the switching station 220 and the gateway server 330 arranged in the network. In the second embodiment, however, an explanation will be given of the case using the gateway server 330.

Fig. 13 is a block diagram showing a configuration of the mobile station 101 according to the second embodiment. In this diagram, the component elements shared by the first embodiment shown in Fig. 2 are designated by the same reference numerals, respectively, and will not be explained.

The difference of this mobile station 101 from that of the first embodiment is that the microcomputer 101b has no location measuring program for calculating the location information. This is by reason of the fact that the location information is calculated in the network as described above.

Fig. 14 is a block diagram showing a configuration of

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the gateway server 330 according to the second embodiment. In this diagram, the component elements shared by the first embodiment shown in Fig. 5 are designated by the same reference numerals, respectively, and will not be described.

The difference of the gateway server 330 from that of the first embodiment is that it has a GPS processing unit 329 for calculating the location information based on the GPS information transmitted from the mobile station 101.

Now, with reference to Fig. 15, the operation of the second embodiment will be explained.

The flow shown in this diagram is different from that of the first embodiment shown in Fig. 7 in that steps Sb7 to Sb9 are executed in place of step Sa7.

Specifically, in step Sb7, the microcomputer 101b of the mobile station 101 receives the radio waves sent out from the GPS satellites by activating the GPS receiving unit 101f.

Then, in step Sb8, the ID information of the GPS satellites and the time points at which the radio waves are sent out are extracted from the radio waves received, and the GPS information including the extracted information and the time points at which the radio waves are received are transmitted to the gateway server 330. The GPS processing unit 329 of the gateway server 330, on the other hand, calculates the location information based on the GPS information transmitted from the mobile station 101 and transmits it to the mobile station 101.

In step Sb9, the microcomputer 101b of the mobile station 101 receives the location information transmitted from the gateway server 330.

The other steps are shared by the first embodiment  
5 described above and will not be explained.

According to this second embodiment, the mobile station 101 may have only the function of receiving the radio waves sent from the GPS satellites, and is not required to execute the process for calculating the location  
10 information based on the information contained in the radio waves. In other words, the processing burden on the mobile station 101 is reduced so that the power consumption is expected to decrease while at the same time reducing the size and weight.

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#### B-1: Modifications of Second Embodiment

##### (1) Variation of location measuring means

The means for measuring the location in collaboration between the mobile station 101 and the gateway server 330  
20 is not limited to the network-type GPS used in the second embodiment.

For example, the location information may be generated by the mobile station 101 using the GPS, and this location information may be corrected by a predetermined node in the  
25 network using the D(Differential)-GPS. Specifically, the base station 210, the switching station 220 or the gateway server 330 may include a GPS correcting unit (not shown) for correcting the GPS measurement of the mobile station

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101 by the D-GPS. This GPS correcting unit corrects the GPS-measured value of the mobile station 101 based on the GPS measurement error of itself. The GPS measurement thus corrected is transmitted to the mobile station 101. By making correction by the D-GPS in this way, the accuracy of the location information is improved.

Also, not only a node in the network but the mobile station 101 itself may have this function of correction by the D-GPS. For example, a D-GPS correction value valid for each of predetermined areas is announced in the predetermined area through the radio channel of the mobile communication network or the FM broadcasting, and the mobile station 101 receives the correction value to correct the GPS measurement.

The location measurement using the base station ID of the mobile communication network as described in the third embodiment later can also be considered as a means for measuring the location in collaboration between the mobile station 101 and the gateway server 330. Thus, such a location measuring means is applicable to the second embodiment.

(2) Also in this second embodiment, what is described with reference to the modifications of the first embodiment above is applicable. Specifically, the modifications (2) to (11) of the first embodiment are applicable.

C: Third Embodiment



Now, a third embodiment of the present invention will be explained.

According to the third embodiment, the location information can be measured in any one of a plurality of different measuring method. Among these measuring methods, the location is measured and the location information is generated by using the method designated by the IP server 500.

In the case under consideration, it is possible to perform the location measurement based on a unit of base station 210 of the mobile communication network in addition to the measurement by network-type GPS. Which of the location measuring means is to be employed is designated by the information added to the hyper link character string corresponding to a menu item.

Fig. 16 is a diagram showing an example of a hyper link character string embedded in a menu item.

As shown in the drawing, a character string ".gps" or ".bs" indicating the location measuring method for the location information is added to the tail of the location information substitution data string "NULLAREA". The character string ".gps" means the location measuring method called the network-type GPS and the character string ".bs" means the location measuring method using the base station ID. The mobile station 101, upon detection of the location information substitution data string from the hyper link character string embedded in the menu item selected by the user, determines the location measuring method to be

executed, by referring to the character string ".gps" or ".bs" added to the data string.

The mobile station 101 according to the third embodiment is different from that of the second embodiment in that the microcomputer 101b is equipped with a program for performing the operation described later.

Fig. 17 is a block diagram showing a configuration of the gateway server 330 according to the third embodiment. In this diagram, the component elements shared by the second embodiment shown in Fig. 14 are designated by the same reference numerals, respectively, and will not be described. The gateway server 330 of the third embodiment is different from the corresponding server of the second embodiment in that it includes a location information generating unit 325 for generating the location information based on the base station ID and an area code data base 328.

The location information generating unit 325 generates the location information of the mobile station 101 in the way described below.

The up signal transmitted from the mobile station 101 toward the IP servers 500A, 500B and so on contains the URL of the IP servers 500A, 500B and so on to which the signal is transmitted and the mobile station ID of the transmitter mobile station 100. Further, the ID of each device is added to the up signal sequentially as it is relayed by each device in the mobile communication network. Specifically, after the up signal is transmitted from the mobile station 100, the base station ID of the base station 210 is first added

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to the signal when received by the base station 210. Further, the packet subscriber processing unit ID of a packet subscriber processing unit 310 is added to the signal when received by the same processing unit 310.

5 Thus, the up signal transmitted from the mobile station 101 comes to contain the URL of any one of the IP servers 500A, 500B and so on of the destination, the mobile station ID, the base station ID and the packet subscriber processing unit ID by the time it is received by the gateway server 320. The location information generating unit 325, 10 by analyzing these ID information, can grasp which mobile station 101 is located in the radio zone of which base station 210.

Also, the location information generating unit 325 15 includes an area code table 328 having stored therein the base station IDs and corresponding area codes of the areas where the respective base stations having the particular base station IDs are located. The location information generating unit 325 searches the area code table 328 using, 20 as a search key, the base station IDs covering the mobile station 10. The area code obtained as the result of this operation and the mobile station ID of the mobile station 101 described above are determined as the location information of the mobile station 101.

25 Fig. 18 is a diagram showing a data format of the area code table 328.

This area code table 328 has stored therein the "base station IDs" that are effective in the mobile communication

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network as the information indicating the location and corresponding "area codes" that can be comprehended, as the information indicating the location, by the IP servers 500A, 500B and so on located outside the network.

5       The base station ID group "BS001 to BS005" shown in the drawing, for example, substantially corresponds to the areas defined as "1-chome, Shibuya-ku, Tokyo", and therefore the area code "CODE001" indicating "1-chome, Shibuya-ku" is stored as information corresponding to the  
10   base station group.

      The other parts of the configuration are similar to those of the second embodiment described above and therefore will not be described.

15   C-1: Operation of Third Embodiment

      Now, the operation of the third embodiment will be explained with reference to Fig. 19.

      The flow shown in this drawing is different from that of the second embodiment shown in Fig. 15 in that steps Sc7  
20   to Sc11 are executed in place of steps Sb7 to Sb9.

      Specifically, in step Sc7, the microcomputer 101b of the mobile station 101 determines a location measuring method for generating the location information. In the concrete, as described above, the location information  
25   substitution data string contained in the hyper link character string is detected, and it is determined whether the character string added to the same data string is ".gps" or ".bs".

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In the case where the determination is that the location measuring method is the network-type GPS, the microcomputer 101b activates the GPS receiving unit 101f to receive the radio wave sent out from the GPS satellites in step Sc8. In step Sc9, the ID information of the GPS satellites and the time point when the radio waves are sent out are extracted from the radio waves received, and the GPS information having added thereto the time point at which the radio waves are received is transferred to the gateway server 330. On the other hand, the GPS processing unit 329 of the gateway server 330 calculates the location information based on the GPS information transferred from the mobile station 101 and transmits it to the mobile station 101. In step Sc10, the microcomputer 101b of the mobile station 101 receives the location information transmitted from the gateway server 330.

In the case where the determination in step Sc7 is the location measuring method using the base station ID, on the other hand, the microcomputer 101b transmits to the gateway server 330 a request signal (up signal) requesting the generation of the location information in step Sc11. This request signal, as described above, contains the mobile station ID of the mobile station 101 which transmits the same signal, and further has progressively added thereto the ID of each device relaying the request signal as it is transmitted to the gateway server 330. In other words, by the time when the request signal transmitted from the mobile station 101 is received by the gateway server 330, it comes

to have added thereto the mobile station ID, the base station ID and the packet subscriber processing unit ID. The location information generating unit 325, by analyzing these ID information, grasps, based on the base station ID, which mobile station 101 is located in the radio zone of which base station 210, and further searching the area code table 328 with this base station ID as a key, transmits the obtained area code to the mobile station 101 as the location information of the mobile station 101. In step Sc10, the microcomputer 101b of the mobile station 101 receives the location information transmitted from the gateway server 330.

The other steps represent the operation shared by the second embodiment and therefore will not be described.

According to this third embodiment, the IP server 500 causes the submenu data supplied to the mobile station 101 to contain the information indicating the location measuring method for the location information, thereby making it possible to obtain the location information calculated by the desired location measuring method.

#### C-2 Modifications of Third Embodiment

(1) Designation of priority order of location measuring methods

According to the third embodiment, a location measuring method is designated by adding, to the hyper link character string, the network-type GPS form ".gbs" or the location measuring method ".bs" using the base station ID.

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SUB 997

SUBA97 The IP server 500, however, can also add the data of a plurality of location measuring methods with the order of priority specified.

In such a case, the hyper link character string is expressed as

"http://xxx.co.jp/cgi-

bin/posi.cgi?posit=BG&qos=NULLQOS&area=NULLAREA&time=NULLTIME&state=NULLSTATE",

where "posit=BG" designates the location measuring method

B (location measuring method using the base station) and the method G (location measuring method using the

network-type GPS) arranged in the descending order of

priority. Also, the mobile station 101 substitutes the employed location measuring method for the "NULLQOS"

portion of "qos=NULLQOS," so that the information as to which location measuring means has been used for location

measurement by the mobile station 101 is notified to the IP server 500.

The mobile station 101, after executing the location

measurement by an executable location measuring means,

generates the location information or the like and transmits

the following up data string, for example, to the IP server

500 of the destination:

"http://xxx.co.jp/cgi-

bin/posi.cgi?posit=BG&qos=G&area=N35.716931E141.722775&time=20010208153344.5+0900&state=MEETING"

which indicates that the mobile station 101 has measured its own location using the location measuring method (G)

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number of GPSs or base stations but, it reduces the location measurement accuracy.

Furthermore, the location measurement with GPS is a method in which the radio waves from a plurality of GPS satellites are received to measure the location by latitude and longitude. Therefore, the accuracy is higher but a longer time is consumed than the location measuring method using the base stations based on the location of the base station covering a cell in which the mobile station 101 is located.

As a result, the IP server 500 designates the desired quality considering the trade-off between the location measurement accuracy and the time required for location measurement according to the purpose for which and the degree of emergency to which the location information is used. In this way, a great variety of needs, of the information-acquiring party, can be met.

More specifically, the quality of the location information may be set in five levels of "B2" to "G4" as shown in Fig. 20A. In this case, as shown in the drawing, the accuracy is highest (high accuracy) but the longest time is required (time; very deteriorated) for "G4" using four GPSs for location measurement. Conversely, the measurement result is obtained earlier (time; much improved) at the sacrifice of a lower accuracy (low accuracy) for "B2" which uses only two base stations for location measurement.

The IP server 500 designates the parameters shown in

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0.5

In the process, the data string transmitted from the mobile station 101 to the IP server 500 is as follows:

"http://xxx.co.jp/cgi-

bin/search.cgi?posit=A&qos=G4&area=N35.716931E141.72277

5 5&time=20010208153344.5+0900", where "qos=G4" indicates that the location measuring method "G4" has been employed.

This method of designating a quality condition presupposes that parameters (Fig. 20B) for designating a quality condition are stored beforehand in the party  
10 acquiring the location information, i.e. the IP server 500. The same parameters are also stored in the mobile station 101, which selects one of the methods usable by itself for measurement in accordance with a parameter designated by the IP server 500.

15 The forms of the parameters are not limited to those in this modification but may be the ones unified and coordinated between the acquisition side and the supply side of the location information. Also, the table of the quality conditions and corresponding measuring methods shown in Fig.  
20 20A are not limited to the form employed in this modification, but may take a different form depending on the location measuring program stored in the microcomputer 101b of the mobile station 101 and the performance thereof.

As described above, this method makes it possible to  
25 supply the location information of an accuracy required by the IP server 500.

(2) Also in this third embodiment, what has been described

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in the modifications of the first embodiment is applicable. Specifically, the modifications (2) to (11) of the first embodiment are applicable to this third embodiment.

5 D: Fourth Embodiment

10 The three embodiments described above assume the following cases. Firstly, the mobile station 101 supplies the IP server 500 with the location information of the mobile station 101 in order to acquire, from the IP server 500 supplying information, the information (the restaurant information, for example) related to the location in which it is located. Secondly, the IP server 500 requests the mobile station 101 to supply the location information in order to acquire the location information of the mobile station 101. The first to third embodiments all presuppose that the hyper link character string has been received in advance from the IP server 500 by the mobile station 101, and the character string is returned, after the mobile station 101 measures its own location, carrying the generated location information and other information such as the location information acquisition time. In other words, the mobile station 101, after receiving the substitution character string containing the location information substitution character string, substitutes the specific location information or the like acquired by the mobile station 101 for the corresponding portion of the received character string and returns it to the IP server 500.

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In the fourth embodiment described below, unlike the first to third embodiments, the mobile station 101 first generates, independently, the location information of itself in response to an instruction from the user. Then, the mobile station 101 transmits the result added to a URL for connecting to an arbitrary, network-connected map site, thereby to transmit the location information of itself to a desired destination. The party that has received this location information accesses the map site indicated by the URL and displays the map indicating the location of the transmitter mobile station 101.

This method is useful, for example, to the user desirous of notifying his/her location to a friend waiting for him/her. Another useful application is as follows. In the case where friends want to notify their location information to each other, for example, the user of a mobile station 101 instructs the particular mobile station 101 to notify the location thereof so that the data string of the URL indicating its own location information is generated, while at the same time transmitting a data string requesting another mobile station 101 carried by the other party friend to notify the location of the mobile communication terminal of the destination. The mobile station 101 of the friend that has received this request returns the location information of itself to the mobile station 101 of the transmitter friend in a manner similar to the one explained above in the first embodiment.

By way of explanation, the transmitter mobile station

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101 starting to transmit the location information thereof is referred to as the mobile station 101A, and the mobile station 101 of the destination as the mobile station 101B.

#### 5 D-1: Configuration of Fourth Embodiment

The configuration of the mobile station 101A according to this embodiment is similar to that of the first embodiment but different only in that the microcomputer 101b has a self location notification program for notifying the location  
10 of itself.

This self location notification program is started by the user of the mobile station 101A inputting, by key operation, the telephone number or the name of the destination registered in the telephone directory on a  
15 screen such as shown in Fig. 21A displayed on the information display unit 101d. The self location notification program accepts the self location notification request from the user and generates the location information by measuring the location of itself by a method similar to the one described  
20 in the first embodiment.

The URL for notifying the self location information is configured of:

"http://mapserv.mapfan.com/cgi-  
bin/map/mapserv.cgi?MAP=self location  
25 information&ZM=9&SZ=120, 120&OPT=30500011&P=e21 self  
location information".

This "self location information" portion (hereinafter referred to as the "self location information

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substitution data string") is substituted for by the specific data of the self location information already acquired.

The URL character string "http://mapserv.mapfan.com" shown here is an example of the map site and may be any site that can accessed through the Internet and performs the service of providing the location information of a terminal. The user of the mobile station 101A is required to sign a service agreement, in advance, with a common carrier for managing a terminal or a map site information provider and prestore the agreed information in its own memory.

Assuming that the self location information data measured is "E139.44.45.80 N35.40.30.18", the data string after substitution is expressed as

"http://mapserv.mapfan.com/cgi-bin/map/mapserv.cgi?MAP=E139.44.45.80N35.40.30.18&ZM=9&SZ=120,120&OPT=30500011&P=e21E139.44.45.80N35.40.30.18"

This constitutes the location information data string (hereinafter referred to as the "self location information data string") for notifying the self location to a destination. This self location information data string is embedded in the following data string as location information and transmitted to the destination:

"<IMG SRC='cti-pos://---.smail/snd-cgi?=U&subject=imakoko&address=destination&body=self location information data string'>"

In the case where the telephone number of the mobile station 101B constituting the destination is "090-1234-

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5678", for example, the data string transmitted to the mobile station 101B is expressed as

"<IMG SRC='cti-pos://---.smaail/snd-cgi?=U&subject=imakoko&address=0901234678&body=http://mapserv.mapfan.com/cgi-bin/map/mapserv.cgi?MAP=E139.44.45.80N35.40.30.18&ZM=9&SZ=120,120&OPT=30500011&P=e21E139.44.45.80N35.40.30.18''>".

The mobile station 101A can notify the location of itself by transmitting this transmission data string to the mobile station 101B.

In the case where it is desired to acquire the location information of the mobile station 101B constituting the destination in addition to the notification of the self location information, on the other hand, the data string requesting the location information of the mobile station 101B is added to the aforementioned transmission data string. In such a case, the transmission data string is given as

"<IMG SRC='cti-pos://---.smaail/snd-cgi?=U&subject=imakoko&address=09012345678&body=http://mapserv.mapfan.com/cgi-bin/map/mapserv.cgi?MAP=E139.44.45.80N35.40.30.18&ZM=9&SZ=120,

120&OPT=30500011&P=e21E139.44.45.80N35.40.30.18''<IMG

SRC='cti-pos://---.smaail/snd-cgi?=U&subject=imakoko&address=09012345679&body=http://mapserv.mapfan.com/cgi-bin/map/mapserv.cgi?MAP=NULLAREA&ZM=9&SZ=120,

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120&OPT=30500011&P=e21NULLAREA''>''>". The character string "address=09012345679" in the second "address=" designates the telephone number for return transmission, i.e. the telephone number of the mobile station 101A. Also, the location information substitution data string "NULLAREA" requests the mobile station 101B to supply the location information. The mobile station 101B that has detected this data string measures the location of itself by a similar method to the first embodiment, and transmits the location of itself to the mobile station 101A.

#### D-2: Operation of fourth embodiment

The operation of the fourth embodiment will be explained below with reference to Fig. 22.

First, the mobile station 101A accepts the menu selection by the user in step Sa1. In the case where the user selects "self location notification menu", the mobile station 101A displays the self location notification menu such as shown in Fig. 21A (step Sa3).

On the self location notification menu displayed on the information display unit 101d, the user first inputs, by key operation, the telephone number or the name registered in the telephone directory of the mobile station 101B constituting the destination, and then selects and executes the "enter".

A screen (Fig. 21B) asking the user whether the user desires to acquire the location information of the mobile station 101B in addition to the self location information

notification is displayed. The user selects YES or NO on the screen by key operation, and then executes "transmission". The microcomputer 101b of the mobile station 101A accepts the request for self location information notification and/or the location information acquisition (step Sa5), and generates the self location information in accordance with the location measuring program stored in the microcomputer 101b (Sa7).

Then, in step Sa9, the location information generated in the preceding step is substituted for the self location information substitution data string thereby to generate the self location information data string. As described above, the following self location information data string is generated as a result:

"http://mapserv.mapfan.com/cgi-bin/map/mapserv.cgi?MAP=E139.44.45.80N35.40.30.18&ZM=9&SZ=120,120&OPT=30500011&P=e21E139.44.45.80N35.40.30.18" (in this case, the location measurement shows that the mobile station 101A is located at "E139.44.45.80 N35.40.30.18").

This self location information data string, as described above, is for indicating the self location on the map site by adding the self location information (the location information expressed in latitude and longitude in this case) to the URL of the existing map site.

The party that has received the URL of this self location information data string can grasp the location of the transmitter terminal or the mobile station 101A in this

case, on the map site, by accessing the map site shown by the URL.

Upon completion of generating the self location information data string in step Sa9, the data string is generated for transmitting the self location information data string to the mobile station 101B constituting the destination (step Sa11). In this case, the telephone number of the mobile station 101B accepted in step Sa5 and the self location information data string generated in the preceding step are built in the transmission data string (step Sa11).

In the case where the telephone number of the mobile station 101B constituting the destination is "090-1234-5678", for example, the data string transmitted to the mobile station 101B is expressed as

```
"<IMG SRC='cti-pos://---.smail/snd-  
cgi?=U&subject=imakoko&address=09012345678&body=http://  
mapserv.mapfan.com/cgi-  
bin/map/mapserv.cgi?MAP=E139.44.45.80N35.40.30.18&ZM=9&  
SZ=120,  
120&OPT=30500011&P=e21E139.44.45.80N35.40.30.18''>"
```

Also, in the case where the user of the mobile station 101A wants to acquire the location information of the mobile station 101B, it is necessary to add also the data string requesting the location information from the mobile station 101B. Specifically, the data string is

```
"<IMG SRC='cti-pos://---.smail/snd-  
cgi?=U&subject=imakoko&address=09012345678&body=http://
```

mapserv.mapfan.com/cgi-  
 bin/map/mapserv.cgi?MAP=E139.44.45.80N35.40.30.18&ZM=9&  
 SZ=120,  
 120&OPT=30500011&P=e21E139.44.45.80N35.40.30.18''<IMG  
 5 SRC=''cti-pos://---.smaill/snd-  
 cgi?=U&subject=imakoko&address=09012345679&body=http://  
 mapserv.mapfan.com/cgi-  
 bin/map/mapserv.cgi?MAP=NULLAREA&ZM=9&SZ=120,  
 120&OPT=30500011&P=e21NULLAREA''>''>"

10 The transmission data string generated in this way is  
 transmitted to the mobile station 101B in step Sa13.

The microcomputer 101b of the mobile station 101B  
 (step Sa15) that has received this data string detects that  
 the data string thus received contains the URL indicating  
 15 the location information of the mobile station 101A and  
 accesses the URL automatically, thereby displaying the map  
 indicating the location of the mobile station 101A on the  
 information display unit 101e of the mobile station 101B  
 (step Sa17).

20 The subsequent operation in the mobile station 101B  
 (the operation of steps Sa19 to Sa39) is similar to the  
 corresponding operation of the first embodiment and  
 therefore each step will not be described in detail. The  
 mobile station 101B, after ascertaining whether the  
 25 location information is permitted to be supplied to the  
 mobile station 101A, i.e. whether the mobile station 101A  
 is registered as a disclosure destination or whether the  
 permission can be obtained from the user or not, measures

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the location and generates the location information of the mobile station 101B and returns the result to the mobile station 101A.

In the case where the request to supply the location information is rejected, as in the first embodiment, the rejection is notified by returning the received data as it is without substitution.

Finally, in step Sa39, the microcomputer 101b of the mobile station 101A detects that the received data string contains the URL indicating the location information of the mobile station 101B and by accessing the particular URL automatically, displays the map indicating the location of the mobile station 101A on the information display unit 101e thereby to end the operation.

Also in the fourth embodiment, what is described with reference to the modifications of the first embodiment is applicable. Specifically, the modifications (3) to (11) of the first embodiment are applicable.